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### (54) SHIELDED TELECOMMUNICATIONS CONNECTOR

ABGESCHIRMTER TELEKOMMUNIKATIONSSTECKER

CONNECTEUR BLINDE DE TELECOMMUNICATIONS

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**EP-A- 0 840 406** **EP-A- 0 847 111**  
**WO-A-99/30388** **WO-A-99/36997**  
**WO-A-99/52182**

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## Description

### BACKGROUND OF THE INVENTION

[0001] The invention relates generally to an enhanced performance connector and in particular to a telecommunications plug having internal shielding to reduce crosstalk. Improvements in telecommunications systems have resulted in the ability to transmit voice and/or data signals along transmission lines at increasingly higher frequencies. Several industry standards that specify multiple performance levels of twisted-pair cabling components have been established. The primary references, considered by many to be the international benchmarks for commercially based telecommunications components and installations, are standards ANSI/TIA/EIA-568-A (/568) Commercial Building Telecommunications Cabling Standard and 150/IEC 11801 (/11801), generic cabling for customer premises. For example, Category 3, 4 and 5 cable and connecting hardware are specified in both /568 and /11801, as well as other national and regional specifications. In these specifications, transmission requirements for Category 3 components are specified up to 16 MHZ. Transmission requirements for Category 4 components are specified up to 20 MHZ. Transmission requirements for Category 5 components are specified up to 100 MHZ. New standards are being developed continuously and currently it is expected that future standards will require transmission requirements of at least 600 MHZ.

[0002] The above referenced transmission requirements also specify limits on near-end crosstalk (NEXT). Often, telecommunications connectors are organized in sets of pairs, typically made up of a tip and ring connector. As telecommunications connectors are reduced in size, adjacent pairs are placed closer to each other creating crosstalk between adjacent pairs. To comply with the near-end crosstalk requirements, a variety of techniques are used in the art. For example, EP 0 840 406 describes a telecommunications plug according to the preamble of claim 1 for use with a cable having a plurality of wires arranged in a plurality of pairs. This telecommunications plug includes a housing and a metal guide plate that provides shielding. This metal guide plate comprises four channels, each of them being able to contain a pair of wires. While there exist plugs, outlets and connecting blocks designed to reduce crosstalk and enhance performance, it is understood in the art that improved plugs, and outlets and connecting blocks are needed to meet increasing transmission rates.

### SUMMARY OF THE INVENTION

[0003] The above-discussed and other drawbacks and deficiencies of the prior art are overcome or alleviated by the enhanced performance connector of the present invention. An exemplary embodiment of the invention is a telecommunications plug for use with a ca-

ble having a plurality of wires arranged in a plurality of pairs, the telecommunications plug including a housing, a load bar positioned within said housing, said load bar positioning said wires relative to each other, and an isolator positioned in said housing, said isolator being conductive and including an isolator body having an isolator top and isolator bottom, a first enclosed channel containing a first pair of wires, a second enclosed channel containing a second pair of wires, a third pair of wires and a fourth pair of wires, said third pair of wires and said fourth pair of wires being positioned between said first enclosed channel and said second channel characterized in that the third pair of wires is positioned on said isolator top and the fourth pair of wires is positioned on said isolator bottom.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Referring now to the drawings wherein like elements are numbered alike in the several figures:

FIG. 1 is an exploded perspective view of a plug;  
FIG. 2 is a perspective view of the housing of the plug in FIG. 1;  
FIG. 3 is a perspective view of the load bar of the plug of FIG. 1;  
FIG. 4 is an end view of the plug of FIG. 1;  
FIG. 5A is a side view of a cable;  
FIG. 5B is an end view of one end of the cable;  
FIG. 5C is an end view of another end of the cable;  
FIG. 6 is perspective view of the load bar of the plug of FIG. 1;  
FIG. 7 is a cross-sectional, perspective view of an alternate housing;  
FIG. 8 is a front view of a housing;  
FIG. 9 is a cross-sectional view of the housing taken along line 21-21 of FIG. 8;  
FIGS. 10-11 are views of an isolator according to the invention.

### DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0005] FIG. 1 is an exploded, perspective view of a plug shown at 500 designed to provide more consistent performance. Plug 500 includes a housing 502 and a load bar 504. The housing is designed to mate with already existing RJ45 outlets (i.e., backwards compatibility). As will be described in more detail below, load bar 504 receives wires and positions the wires in proper locations for reducing crosstalk. Load bar 504 is inserted through opening 503 in housing 502. Load bar 504 is generally rectangular and includes recesses 506 that receive shoulders 508 formed in the interior of housing 502. Load bar 504 includes a first set of wire receiving channels 510 arranged in a first plane and a second set of wire receiving channels 512 positioned in a second plane different from the first plane. In a preferred em-

bodiment, the first plane is substantially parallel to the second plane. The wire receiving channels 510 are wide enough to slip the wires in, but narrow enough, that once the wires are in position the wires are held in place during the loading process. Wire receiving channels 512 include a tapered entrance 514 to facilitate installation of the wire. A series of separate slots 516 are formed in the housing 500 for providing a path for an insulation displacement contact to contact wires positioned in wire receiving channels 510 and 512. The slots 516 are separate thereby preventing adjacent insulation displacement contacts from touching each other. Three ridges 518 are formed on the inside of housing 502. Each ridge 518 is positioned between two adjacent wire receiving channels 510 and aids in positioning the wires relative to slots 516. The load bar 504 shown in FIG. 1 is designed to receive eight wires, six in the first plane and two in the second plane. It is understood that the plug 500 can be modified to receive more or less wires without departing from the invention.

[0006] FIG. 2 is a perspective view of the housing 502. Ridges 518 angle downwards towards the load bar and then proceed parallel to the wire receiving channels 510 in load bar 504. The angled opening in housing 502 facilitates insertion of the load bar 504 into housing 502.

[0007] FIG. 3 is a perspective view of the load bar 504. Each wire receiving channel 510 is semi-circular. Adjacent wire receiving channels 510 receive a tip and ring conductor from a respective pair and have a lip 520 positioned therebetween to position the wires accurately. A barrier 522 is provided between adjacent pairs of wire receiving channels 510. Barriers 522 help keep tip and ring conductors from different pairs from being crossed and have a height greater than that of the wires. Barriers 522 are positioned directly above wire receiving channels 512 in the second plane.

[0008] As shown in FIG. 3, wire receiving channels 512 straddle a central pair of wire receiving channels 510 in accordance with conventional wiring standards. Barriers 522 include slots 524 formed through the top surface of barrier 522 and entering wire receiving channel 512. Slots 524 provide an opening for an insulation displacement contact to contact wires placed in wire receiving channels 512. Slots 524 are aligned with slots 516 in housing 502 when the load bar 504 is installed in the housing.

[0009] FIG. 4 is an end view of plug 500 with the load bar 504 installed in the housing 502. Ridges 518 include opposed semi-circular surfaces that have a similar radius to the semi-circular surface of wire retaining channels 510. Opposed semi-circular surfaces 526 help position the wires in the wire receiving channels 510 so that the wires are aligned with the slots 516 in housing 502. A first surface 526 is directed towards one of the wire receiving channels 510 and the opposite surface 526 is directed towards the other wire receiving channel 510 of a pair of adjacent wire receiving channels. Ridges 518 are substantially parallel to wire receiving channels 510

and extend along the entire length of the wire receiving channels 510. Insulation displacement contacts are positioned in slots 516 and engage the wires in wire receiving channels 510 and 512. As is known in the art, longer insulation displacement contacts are needed to engage the wires in wire receiving channels 512.

[0010] Installation of wires in the load bar 504 will now be described. FIGS. 5A and 5B are side and end views, respectively, of a cable having four pairs of wires. The four pairs are labeled Gr (green), Br (brown), Bl (blue) and Or (orange). Each pair includes two wires, one wire designated the tip conductor and the other wire designated the ring conductor. In the un-installed state, the individual wires of each pair are twisted (i.e. the tip and ring conductors are twisted around each other). FIG. 5C is an end view of the opposite end of the cable shown in FIG. 5B.

[0011] For the end of the cable shown in FIG. 5B, the load bar 504 will be loaded in the following way. First, the cable jacket will be stripped off approximately 1.5" from the end. Next, pairs Br and Gr will be swapped in position as shown in FIG. 5B. To do this, pair Gr will cross between pair Br and pair Bl. This will create a separation between pair Br and the split pair Bl. Pair Bl is referred to as the split pair because it is spread over an intermediate pair in conventional wiring standards. As shown in FIG. 6, pair Br is positioned between the conductors of the split pair Bl. The tip and ring wires of the Bl pair will be untwisted up to a maximum of 0.5" from the cable jacket, such that the wires in the pair are oriented correctly. The Bl pair will then be laced into the load bar 504 in wire receiving channels 512 as shown in FIG. 6, and pulled through until the twisted wires contact the load bar. The remaining pairs Or, Br and Gr will be untwisted as little as necessary and placed in their appropriate wire receiving channels 510 such that no pairs are crossed. The tip and ring conductors for each pair are kept adjacent in wire receiving channels 510. The wires are then trimmed as close to the end of the load bar 504 as possible.

[0012] The pairs that are kept together, Or, Br and Gr are positioned in the first plane of wire receiving channels 510. The split pair Bl that straddles another pair Br, in accordance with conventional wiring standards, is placed in the second plane of wire receiving channels 512. The split pair Bl usually contributes greatly to near end crosstalk (NEXT). By positioning this pair in a second plane defined by wire receiving channels 512, separate from the first plane defined by wire receiving channels 510, the crosstalk generated by the split pair is reduced.

[0013] For the end of the cable shown in FIG. 5C the load bar will be loaded in the following way. First, the cable jacket will be stripped off approximately 1.5" from the end. Next pair Or and pair Bl will be swapped in position as shown in FIG. 5C. To do this, pair Or will cross between pair Br and pair Bl. This will create a separation between pair Br and the split pair Bl. The wires are then

placed in the load bar 504 as described above.

[0014] The load bar 504 is then inserted into the housing 502. There is a slight interference fit between the load bar 504 and the housing 502 that secures the load bar 504 to the housing 502. Recesses 506 receive shoulders 508 in the housing 502. When the load bar 504 is properly positioned in the housing, wire receiving channels 510 are aligned with slots 516. The two slots 524 and two wire receiving channels 512 are also aligned with two slots 516. Contact blades having insulation displacement ends are then positioned in slots 516 and crimped so as to engage the wires in the wire receiving channels 510 and 512. It is understood that the contact blades for the split pair positioned in wire receiving channels 512 will be longer than the contact blades for the wires positioned in wire receiving channels 510. Telecommunications plug 500 provides several advantages. First, the amount of untwist in each pair is minimized and controlled by the load bar. The location of each pair is also regulated by the load bar and the load bar prevents buckling of wires because the wires do not have to be pushed into the plug. Thus, the plug has a very small and consistent range of transmission performance. This is advantageous particularly when crosstalk compensation circuitry must be tuned to the plug performance. Terminating the wire inside the load bar creates a more simple final assembly.

[0015] FIG. 7 is a cross-sectional, perspective view of a housing 502 having an integrated load bar 754. The integrated load bar 754 is integrally formed with the housing 502. The integrated load bar 754 includes wire receiving channels 510 and wire receiving channels 512 as described above. The wire receiving channels 510 and 512 include tapered lead-in surfaces 513 to facilitate insertion of the wires in the wire receiving channels 510 and 512.

[0016] A plug insert is used with a plug housing 552 shown in FIG. 8. As shown in FIG. 8, the plug housing 552 is similar to plug housing 502. Plug housing 552 includes protrusions 554 on the inside, top surface of the housing 552. The protrusions 554 are also shown in the cross-sectional view in FIG. 9. In the embodiment shown in FIG. 9, the protrusions 554 are triangular. It is understood that other shapes may be used and the invention is not limited to triangular protrusions. The protrusions 554 are positioned to contact wires in positions 3 and 6 above wire receiving channels 512 and direct the wires in positions 3 and 6 downwards and away from the wires in positions 1, 2, 4, 5, 7 and 8. As noted above, the wires are typically grouped in tip and ring pairs in which wires 1 and 2 form a pair, wires 4 and 5 form a pair, wires 3 and 6 form a pair and wires 7 and 8 form a pair. The protrusions 554 separate the wires in positions 3 and 6 from the remaining wires thereby reducing crosstalk as described above.

[0017] FIGS. 10 and 11 are views of an isolator 1100. The isolator 1100 is conductive and may be made from plastic which is then metallized, a conductive polymer

or metal. As shown in FIGS. 10 and 11, the isolator 1100 includes a body 1102 having a plurality of enclosed channels 1104 formed through the body 1102. Each channel 1104 receives a pair of wires to isolate the pairs from each other. The enclosed channels 1104 completely surround wire pairs and provide 360 degree shielding. Also formed in the body 1102 are grooves 1106, each of which receives a wire pair. The grooves 1106 do not provide 360 degree shielding but surround approximately 180 degrees of the wire pair.

[0018] The embodiments described herein are for use with eight conductors (i.e., four twisted pairs) but it is understood that the invention may be used with any number of conductors and is not limited to eight.

[0019] While preferred embodiments have been shown and described, various modifications and substitutions may be made thereto without departing from the scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustration and not limitation.

#### Claims

1. A telecommunications plug for use with a cable having a plurality of wires arranged in a plurality of pairs, the telecommunications plug including a housing, a load bar positioned within said housing, said load bar positioning said wires relative to each other, and an isolator positioned in said housing, said isolator (1100) being conductive and including an isolator body (1102) having an isolator top and isolator bottom, a first enclosed channel (1104) for containing a first pair of wires, a second enclosed channel (1104) for containing a second pair of wires, the cable further comprising a third pair of wires and a fourth pair of wires, said third pair of wires and said fourth pair of wires being positionable between said first enclosed channel and said second enclosed channel, **characterized in that** the third pair of wires is positionable on said isolator top and the fourth pair of wires is positionable on said isolator bottom.
2. The telecommunications plug according to claim 1, **characterized in that** said isolator (1100) is made from metal.
3. The telecommunications plug according to claim 1, **characterized in that** said isolator (1100) is made from plastic coated with a conductor.
4. The telecommunications plug according to claim 1, **characterized in that** said isolator (1100) is made from conductive plastic.
5. The telecommunications plug according to claim 1, **characterized in that** said isolator top includes a

groove (1106) formed therein, said groove partially surrounding said third pair of wires received in said groove.

6. The telecommunications plug according to claim 5, **characterized in that** said isolator bottom (1106) includes a further groove formed therein, said further groove partially surrounding said fourth pair of wires received in said further groove.
7. The telecommunications plug according to claim 1, **characterized in that** the load bar aligns a portion of said wires in a single plane; and said housing includes an insulative protrusion for contacting at least one of said wires and diverting said at least one of said wires away from said plane.
8. The telecommunications plug according to claim 7, **characterized in that** said housing includes two protrusions.
9. The telecommunications plug according to claim 8, **characterized in that** said wires are arranged in eight positions, said pairs include wires in positions 1 and 2, wires in positions 3 and 6, wires in positions 4 and 5 and wires in positions 7 and 8; said protrusions contacting wires in positions 3 and 6.

#### Patentansprüche

1. Telekommunikationsstecker zur Verwendung mit einem Kabel, das eine Vielzahl von in einer Vielzahl von Paaren angeordneten Drähten aufweist, wobei der Telekommunikationsstecker ein Gehäuse, eine innerhalb des genannten Gehäuses positionierten Load-Bar, wobei die genannte Load-Bar die genannten Drähte relativ zueinander positioniert, und einen in dem genannten Gehäuse positionierten Abstandhalter aufweist, wobei der genannte Abstandhalter (1100) leitend ist und einen Abstandhalterkörper (1102), der eine Oberseite und eine Unterseite aufweist, einen ersten eingeschlossenen Kanal (1104) für die Aufnahme eines ersten Paares von Drähten, einen zweiten eingeschlossenen Kanal (1104) für die Aufnahme eines zweiten Paares von Drähten, wobei das Kabel des weiteren ein drittes Paar Drähte und ein viertes Paar Drähte aufweist, wobei das genannte dritte Paar Drähte und das genannte vierte Paar Drähte zwischen dem genannten ersten eingeschlossenen Kanal und dem genannten zweiten eingeschlossenen Kanal angeordnet sind, **dadurch gekennzeichnet, dass** das dritte Paar Drähte an der genannten Oberseite und das vierte Paar Drähte an der genannten Unterseite angeordnet werden kann.

2. Telekommunikationsstecker nach Anspruch 1, **dadurch gekennzeichnet, dass** der genannte Abstandhalter (1100) aus Metall hergestellt wird.

3. Telekommunikationsstecker nach Anspruch 1, **dadurch gekennzeichnet, dass** der genannte Abstandhalter (1100) aus einem leitend beschichteten Kunststoffmaterial hergestellt wird.

4. Telekommunikationsstecker nach Anspruch 1, **dadurch gekennzeichnet, dass** der genannte Abstandhalter (1100) aus leitendem Kunststoffmaterial hergestellt wird.

5. Telekommunikationsstecker nach Anspruch 1, **dadurch gekennzeichnet, dass** die genannte Abstandhalteroberseite eine daran ausgebildete Rille (1106) aufweist, wobei die genannte Rille das genannte in der genannten Rille aufgenommene Paar Drähte teilweise umgibt.

6. Telekommunikationsstecker nach Anspruch 5, **dadurch gekennzeichnet, dass** die genannte Abstandhalterunterseite eine weitere daran ausgebildete Rille (1106) aufweist, wobei die genannte weitere Rille das genannte in der genannten weiteren Rille aufgenommene Paar Drähte teilweise umgibt.

7. Telekommunikationsstecker nach Anspruch 1, **dadurch gekennzeichnet, dass** die Load-Bar einen Teil der genannten Drähte auf ein und derselben Ebene aneinanderreicht und das genannte Gehäuse einen isolierenden Überstand für das Kontaktieren zumindest eines der genannten Drähte und das Ablenken des genannten mindestens einen der genannten Drähte von der genannten Ebene weg aufweist.

8. Telekommunikationsstecker nach Anspruch 7, **dadurch gekennzeichnet, dass** das genannte Gehäuse zwei Überstände aufweist.

9. Telekommunikationsstecker nach Anspruch 8, **dadurch gekennzeichnet, dass** die genannten Drähte in acht Positionen angeordnet sind, wobei die genannten Paare Drähte in den Positionen 1 und 2, Drähte in den Positionen 3 und 6, Drähte in den Positionen 4 und 5 und Drähte in den Positionen 7 und 8 aufweisen, wobei die genannten Überstände in den Positionen 3 und 6 Drähte kontaktieren.

#### Revendications

1. Fiche de télécommunication pour une utilisation avec un câble comportant une pluralité de fils agencés en une pluralité de paires, la fiche de télécommunication comprenant un boîtier, une barre de

fixation positionnée dans ledit boîtier, ladite barre de fixation positionnant lesdits fils les uns par rapport aux autres, et un isolateur positionné dans ledit boîtier, ledit isolateur (1100) étant conducteur et comprenant un corps d'isolateur (1102) ayant un dessus d'isolateur et un dessous d'isolateur, un premier canal fermé (1104) pour contenir une première paire de fils, un deuxième canal fermé (1104) pour contenir une deuxième paire de fils, le câble comprenant en outre une troisième paire de fils et une quatrième paire de fils, ladite troisième paire de fils et ladite quatrième paire de fils pouvant être positionnées entre ledit premier canal fermé et ledit deuxième canal fermé, **caractérisée en ce que** la troisième paire de fils peut être positionnée sur ledit dessus de l'isolateur et la quatrième paire de fils peut être positionnée sur ledit dessous de l'isolateur.

des fils aux positions 1 et 2, des fils aux positions 3 et 6, des fils aux positions 4 et 5 et des fils aux positions 7 et 8 ; lesdites protubérances étant en contact avec les fils aux positions 3 et 6.

2. Fiche de télécommunication selon la revendication 1, **caractérisée en ce que** ledit isolateur (1100) est réalisé en un métal. 5
3. Fiche de télécommunication selon la revendication 1, **caractérisée en ce que** ledit isolateur (1100) est réalisé en un plastique revêtu d'un conducteur. 10
4. Fiche de télécommunication selon la revendication 1, **caractérisée en ce que** ledit isolateur (1100) est réalisé en un plastique conducteur. 15
5. Fiche de télécommunication selon la revendication 1, **caractérisée en ce que** ledit dessus de l'isolateur comprend une rainure (1106) formée dans celui-ci, ladite rainure entourant partiellement ladite troisième paire de fils reçue dans ladite rainure. 20
6. Fiche de télécommunication selon la revendication 5, **caractérisée en ce que** ledit dessous de l'isolateur (1106) comprend une autre rainure formée dans celui-ci, ladite autre rainure entourant partiellement ladite quatrième paire de fils reçue dans ladite autre rainure. 25
7. Fiche de télécommunication selon la revendication 1, **caractérisée en ce que** la barre de fixation aligne une partie desdits fils dans un plan unique ; et ledit boîtier comprend une protubérance isolante pour venir en contact avec au moins un desdits fils et écarter ledit au moins un desdits fils dudit plan. 30
8. Fiche de télécommunication selon la revendication 7, **caractérisée en ce que** ledit boîtier comprend deux protubérances. 35
9. Fiche de télécommunication selon la revendication 8, **caractérisée en ce que** lesdits fils sont agencés dans huit positions, lesdites paires comprennent 40

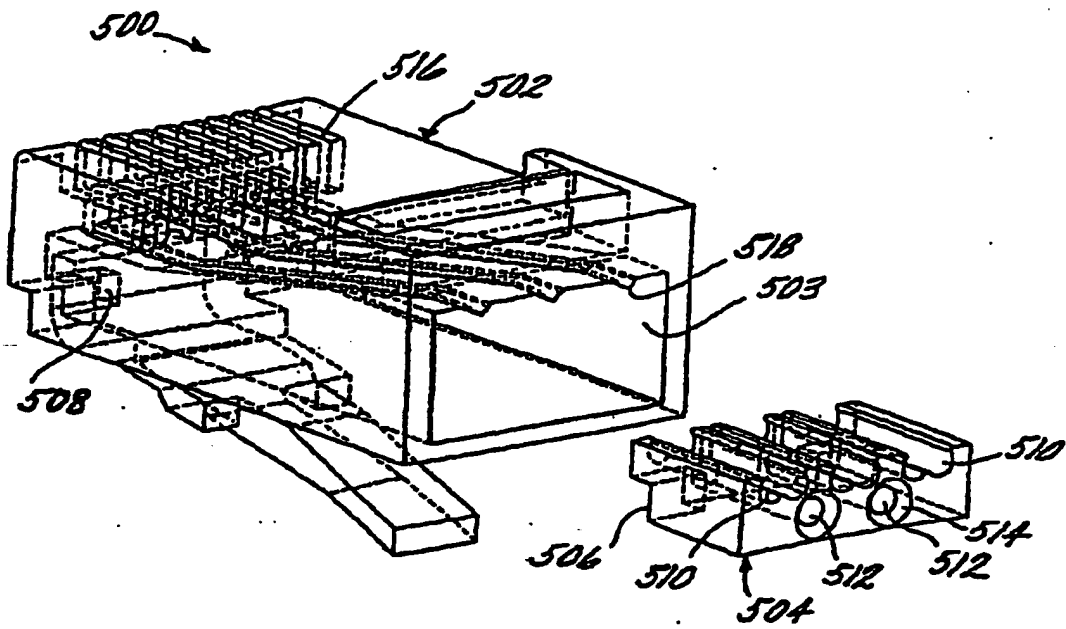


FIG. 1

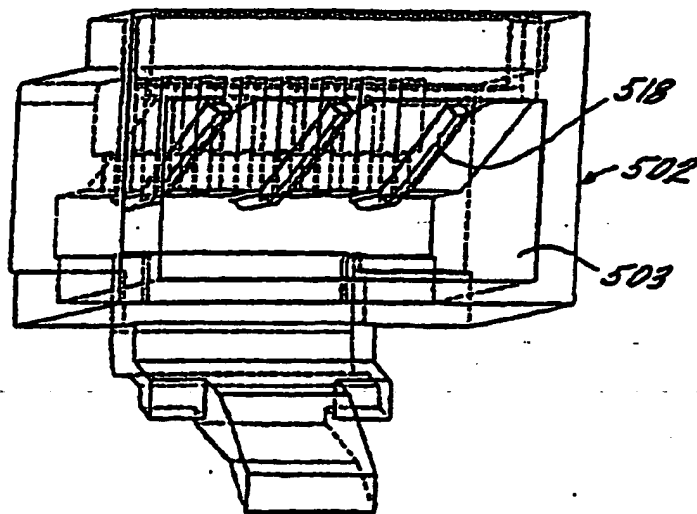
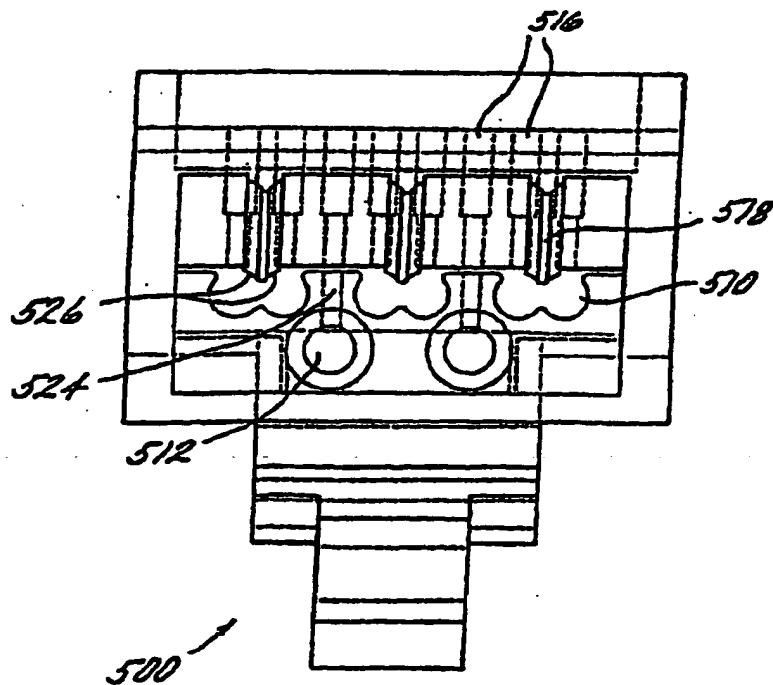
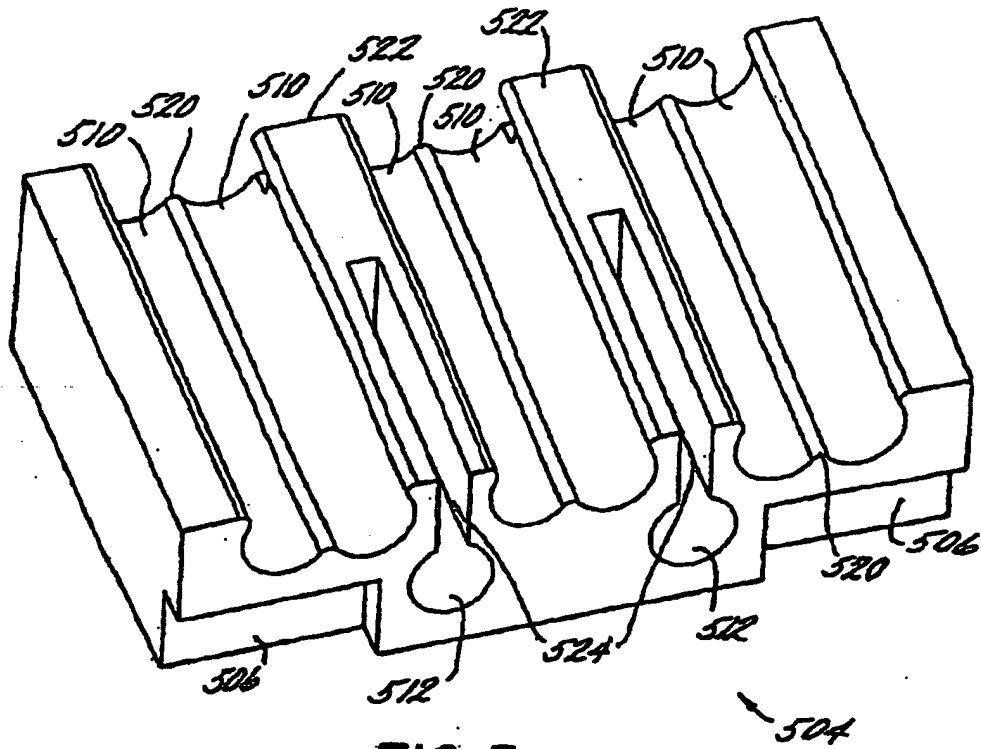
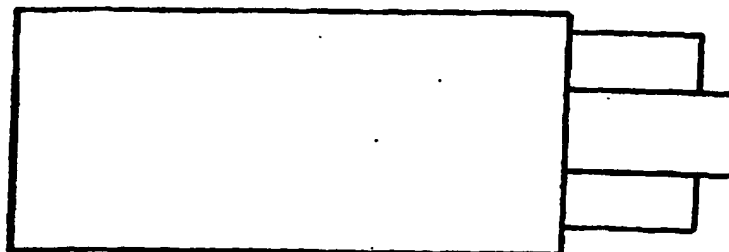
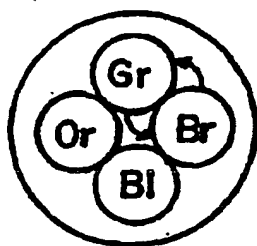


FIG. 2

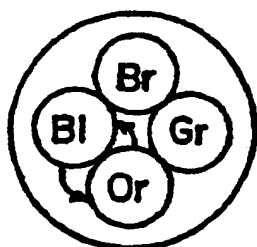




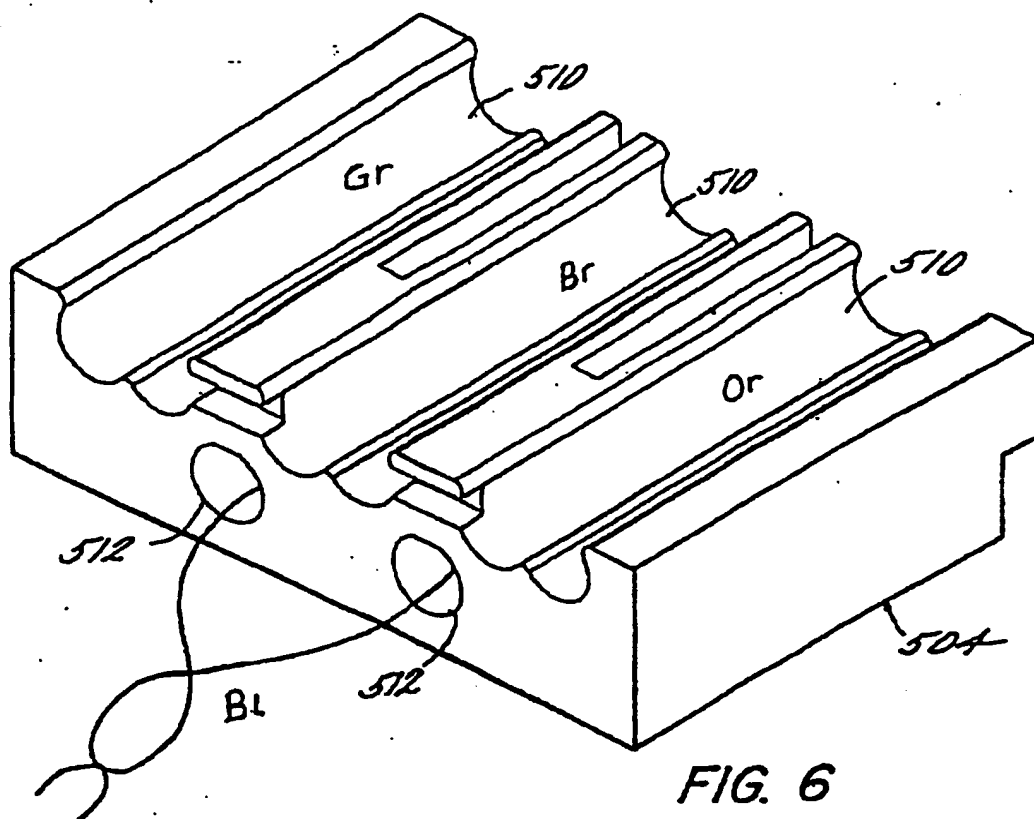
*FIG. 5A*



*FIG. 5B*



*FIG. 5C*



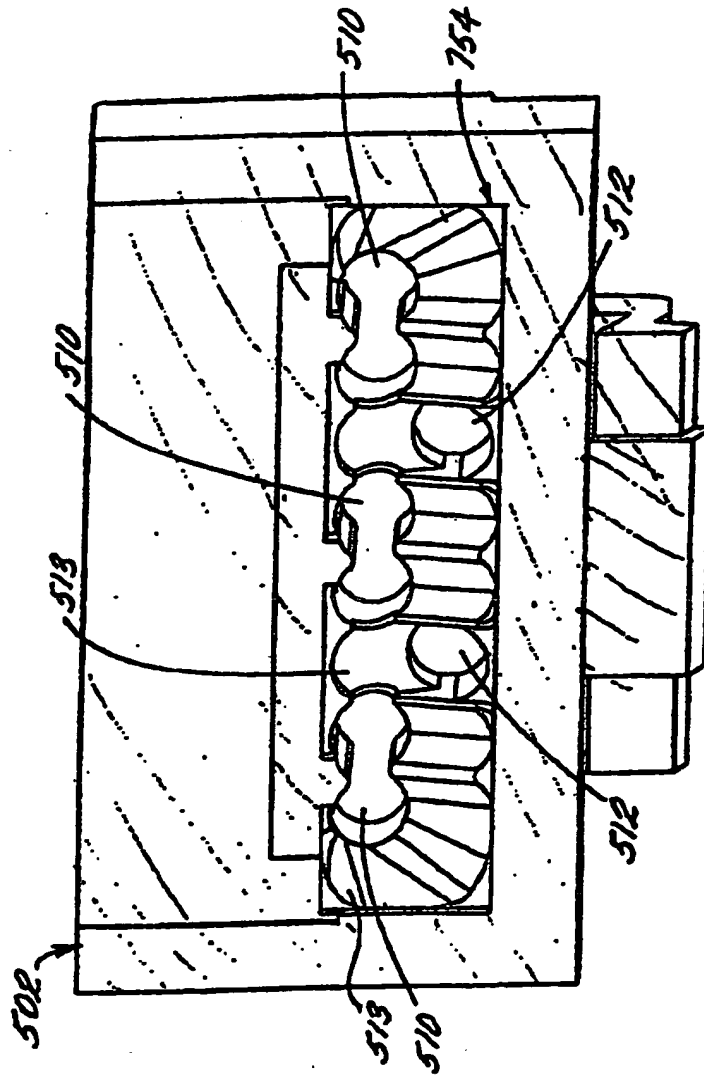


FIG. 7

